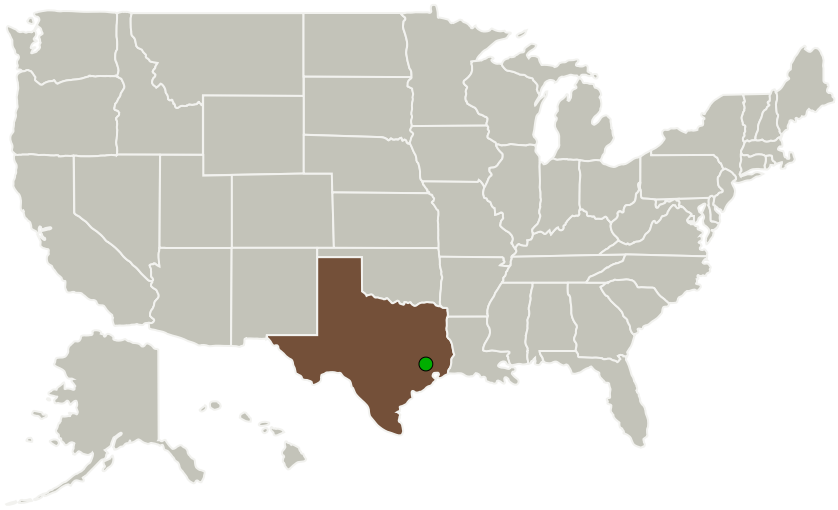
Advanced Modeling Tools for Controlling Complex Assets Across Time Delay, Phase I

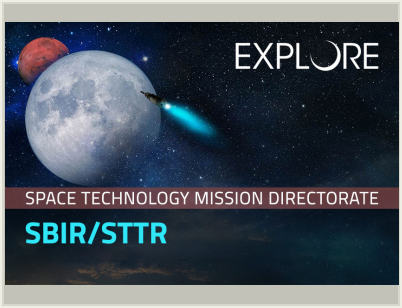
Completed Technology Project (2010 - 2010)

Project Introduction

Prior to human arrival, lunar robots will conduct a variety of precursor operations. Some of these will need supervision from Earth. After humans arrive, robots will continue to follow a mix of autonomy, local control, and ground control. For best utility, a strong model is needed of the expected responses of the robots to various commands. Such a model enables procedure authors to verify expected outcomes, enhances situational awareness for remote operators in the presence of time delay, and provides a mechanism for planning. We propose a simulation module for assisting an operator across a time delay. The proposed innovation is a hybrid simulation module to replace the current "Behavioral Sim" in JSC's Predictive Interactive Graphical Interface (PIGI). PIGI helps an operator compensate for lunar-scale time delay, and is part of NASA's "RAPID Workbench". The Behavioral Sim acts as an oracle, taking initial conditions and a sequence of commands and producing trajectories and expected final location of the robot. We propose to provide functionality to (1) keep and reason about the robot's internal state; (2) model relevant aspects of the robot's workspace; (3) reason at a high level about manipulation; and (4) model the uncertainty cone of the predictions.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
TRACLabs, Inc.	Lead Organization	Industry	Webster, Texas
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations
Texas

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140105)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TRACLabs, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Robert Burridge

Co-Investigator:

Robert R Burridge

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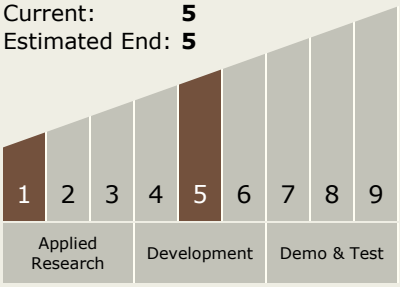
Technology Maturity (TRL)

Start: **1**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.4 Execution and Control

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System